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PRODUCTION OF PLATELET-LIKE PARTICLES USING MEG-01 CELLS

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Platelets are small cell fragments derived from mature megakaryocytes, cells that primarily reside in the bone marrow. Platelets circulate throughout the body within the blood and are responsible for hemostasis and thrombosis. Platelets also play a prominent role in the body's immune system and inflammatory response. With platelets providing these critical functions, platelet transfusions are used to alleviate low platelet levels in patients suffering from cancer, immune disorders, or traumatic injuries. Unfortunately, platelets used in transfusion medicine must be harvested from human donors and only have a shelf-life of 5-7 days, leading to shortages in emergency situations. A supply of culture-derived and donor-independent human platelets is needed to help mitigate the platelet shortage in transfusion medicine. Finding a high-throughput method for producing an on-demand supply of platelets is vital to those who rely on platelet transfusions for survival.

This research focuses on engineering a microfluidic system equipped with a syringe filter to create an on-demand supply of donor-independent platelet-like particles from MEG-01 cells, an immortalized megakaryocytic cell line. The microfluidic system was shown to produce viable platelet-like particles that expressed CD41a, a common surface receptor found on natural blood platelets. Additionally, it was shown that culturing MEG-01 cells with phorbol 12-myristate 13-acetate increased the CD41a expression in platelet-like particles. After conducting initial experiments using MEG-01 cells, future work includes infusing murine megakaryocytes through the microfluidic system and investigating the functional properties of the platelets produced. Additionally, the in vivo effects of the platelets generated from the microfluidic system would be examined by injecting them into a thrombocytopenic mouse. These results could determine the feasibility of using this microfluidic method of platelet production for human therapies. The work presented here could provide a significant stepping-stone for clinical applications of producing an on-demand supply of donor-independent platelets for transfusion medicine. This would allow immediate treatment for patients experiencing low platelet levels and ultimately lead to lives being saved.